Experimental investigations on the effects of coiling and bends on the sound energy losses through a resonator tube

Abstract:

In order to miniaturize the thermoacoustic engine, thereby to increase their potential applications, coiling the resonator tube is one of the solutions to make it smaller in size (rather than scaling the engine). Whether in a standing wave or travelling wave engine, a resonator is necessary to sustain the driving acoustic waves. However, the curvature of the tube may introduce losses that are not encountered by the normal straight resonator. A straight resonator tube is the easiest design and will have small losses, but it requires large space. However, there are only few studies regarding the effect of resonator coiling. This work investigates the effect of the coiling of the tubes and the bends effects on the efficiency of the sound energy transmission through the tube experimentally. This work consists of the design of an impedance tube system to measure the sound energy losses of coiled tubes of different configurations and comparing the results with the losses in a straight tube. A similar investigation is also conducted for different number of sharp turns of the tubes (u-shaped bend and 90 bend tube).The impedance tube system designed for the testing consists of an upstream tube, the test section and a downstream tube. The two load method was used to analyze the results by using the four-microphone impedance tube technology. The results showed significant differences between the four configurations and the outcomes were found to be very useful in the future when designing thermoacoustic looped engine.